

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 10/822,708 Confirmation No. 2911

Applicant : WATANABE, H. et al.

Filed : April 13, 2004

Title : STORAGE CONTROL SUB-SYSTEM COMPRISING
VIRTUAL STORAGE UNITS

TC/AU : 2157

Examiner : TBD

Docket No. : 1309.43767X00

Customer No.: 24956

**PETITION TO MAKE SPECIAL
UNDER 37 CFR §1.102(d) (MPEP §708.02(VIII))**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The Applicants petition the Commissioner to make the above-identified application special in accordance with 37 CFR §1.102(d). In support of this Petition, pursuant to MPEP § 708.02(VIII), Applicants state the following.

(A) REQUIRED FEE

This Petition is accompanied by the fee set forth in 37 CFR § 1.117(h).
Payment of the fee has been made in the manner set forth below in section (G).

(B) ALL CLAIMS ARE DIRECTED TO A SINGLE INVENTION

Claims 1-7 are pending in the application. All the pending claims of the application are directed to a single invention. If the Office determines that all claims in the application are not directed to a single invention, Applicant will make election without traverse as a prerequisite to the grant of special status in conformity with established telephone restriction practice.

Under claim 1, the sole independent claim currently pending, the invention is a storage control sub-system of a storage control system connected to a host terminal, comprising: a logical storage device having a logical storage region for storing data in a logical fashion; a physical storage device, comprising said logical storage device, for storing said logically stored data, in a physical fashion; a virtual storage unit having a virtual storage region and being implemented in said storage control sub-system in a case where a virtual storage capacity value is established; a memory for storing said established virtual storage capacity value; and a storage control section for creating an association between a virtual storage region in said virtual storage unit and a logical storage region in said logical storage device if a read request or write request is received from said host terminal which recognizes said virtual storage unit, and exchanging data between said logical storage region and said host terminal, via said virtual storage region; wherein said storage control section reports the virtual storage capacity value stored in said memory, to said host terminal, and ensures that, after said host terminal has stored said virtual storage

capacity value, said reported virtual storage capacity value is not changed while said virtual storage unit is recognized by said host terminal.

(C) PRE-EXAMINATION SEARCH

A pre-examination search has been conducted, directed to the invention as claimed. The pre-examination search was conducted in the following US Manual of Classification areas:

<u>Class</u>	<u>Subclass</u>
707	1, 204
709	203
711	4, 111-112, 114, 154, 203
719	325

Furthermore, a keyword search was conducted on the USPTO's EAST database, including the US patent database, the published patent applications database, and the European and Japanese patent abstract databases. In addition, a search for non-patent literature was conducted on the ACM (Association for Computing Machinery) online databases.

(D) REFERENCES DEEMED MOST-CLOSELY RELATED TO THE SUBJECT MATTER ENCOMPASSED BY THE CLAIMS

Based upon a review of the documents located by the search and the documents previously of record in the application, the references deemed to be most-closely related to the subject matter encompassed by the claims are listed below. These documents were made of record in the present application by the Information Disclosure Statement filed May 31, 2005.

<u>Document No.</u>	<u>Inventor</u>
US 5696934	Jacobson et al.
US 6557073	Fujiwara et al.
US 20030204701	Mimatsu et al.
US 20040225697	Asano et al.
US 20050071559	Tamura et al.

Because all of the above-listed references are already of record in the present application, in accordance with MPEP § 708.02(VIII)(D), additional copies of these documents have not been submitted with this Petition.

(E) DETAILED DISCUSSION OF THE REFERENCES

The references deemed most-closely related are discussed below in section (E)(2), pointing out, with the particularity required by 37 CFR 1.111 (b) and (c), how the claimed subject matter is patentable over the teachings of these documents.

1. Discussion of the Invention

Under the invention, a storage control subsystem of a storage control system connected to a host terminal achieves at least one of the following objects: (A) reducing wasted empty storage space if a logical unit (LU) pair is formed, and the LU pair has a large storage capacity; and (B) reducing the possibility of causing confusion in a host that might result from reporting storage capacities of differing sizes for the same LU.

Accordingly, it is submitted that the present invention is patentable over the cited references because, as set forth in independent claim 1, a first feature of the

invention includes creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received from a host terminal which recognizes the virtual storage unit, and exchanging data between the logical storage region and the host terminal, via the virtual storage region.

An second feature of the invention recited in claim 1 includes that a storage control section reports a virtual storage capacity value to the host terminal, and ensures that, after the host terminal has stored the virtual storage capacity value, the reported virtual storage capacity value is not changed while the virtual storage unit is recognized by the host terminal. As will be discussed in more detail below, the prior art does not teach or suggest the above-described features.

2. Discussion of the References Deemed to be Most-Closely Related

The patent to Jacobson et al., US 5696934, discloses a method for fully utilizing storage capacity of in a disk array having storage disks of differing capacities. RAID areas are formed from contiguous regions across multiple disks, such that the contiguous regions represent physical storage space at the same physical addresses in individual storage disks. Alternatively, non-contiguous regions may be linked to form RAID areas. The storage space of the disks is mapped into a first or intermediate virtual view of the physical storage space. The first virtual view is conceptually a set of RAID areas which, when viewed by a user or host application program, represent one large storage space indicative of the storage space on the

disks. The mirror and parity RAID areas may or may not consume the entire storage space of the disk array. Accordingly, during certain applications, there may be unused and undesignated storage space that does not correspond to a particular RAID area. However, such storage space can be converted into a mirror or parity RAID area. The storage space available in the RAID areas is mapped into a second or front end virtual view, which is a view of storage presented to the user or host application program, and which also represents a single large storage capacity indicative of the storage space available on the disks. (See e.g. column 2, line 34, through column 3, line 2, and column 7, line 26, through column 10, line 48.) However, unlike the present invention, Jacobson et al. do not teach creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received. More particularly, Jacobson et al. do not disclose creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received from a host terminal which recognizes the virtual storage unit, and exchanging data between the logical storage region and the host terminal, via the virtual storage region, as set forth in claim 1. Furthermore, Jacobson et al. do not disclose that a storage control section reports a virtual storage capacity value to the host terminal, and ensures that, after the host terminal has stored the virtual storage capacity value, the reported virtual storage capacity value is not changed while the virtual storage unit is recognized by the host terminal, as also recited in claim 1.

The patent to Fujiwara et al., US 6557073, discloses a host computer 1 connected via a data transfer control program 41 to a virtual tape information database 61, a virtual storage area space map 62, and a virtual storage area 50. A value stored in a "total block size" is added for all virtual tape volumes. This value is compared with a capacity of virtual storage area 50 in order to know the remaining capacity of the virtual storage area 50. A write mode field indicates that a virtual tape volume should be written to a real tape volume. The data transfer control program 41 receives the read request and updates the related fields of the virtual tape information database 61 and real tape information database 63. The data transfer control program 41 outputs a stage-in request to the real tape volume 21. (See, e.g., column 5, lines 20-51; column 6, lines 36-49; column 8, lines 15-49; column 9, lines 45-67; Figures 2-10B, and 16.) However, unlike the present invention, Fujiwara et al. do not disclose creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received. More particularly, Fujiwara et al. do not disclose creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received from a host terminal which recognizes the virtual storage unit, and exchanging data between the logical storage region and the host terminal, via the virtual storage region, as set forth in claim 1. Additionally, Fujiwara et al. do not disclose that a storage control section reports a virtual storage capacity value to the

host terminal, and ensures that, after the host terminal has stored the virtual storage capacity value, the reported virtual storage capacity value is not changed while the virtual storage unit is recognized by the host terminal, as also recited in claim 1.

The published patent application to Mimatsu et al., US 20030204701, discloses host computers 400 with a volume manager 402, and a virtual volume managing table 605 on a managing server 600. An information indicating a storage capacity of each LU is registered into a capacity entry. An information indicating a correspondence relationship between the virtual volumes provided for users and the LUs of the disk array system 100 is registered into the virtual volume managing table 605. The managing server 600 records an acquired device identifier 112 into a corresponding entry in a device managing table 604. A Logical Unit (LU) is recognized from host computer (step 7012 of FIG. 8), and then a virtual volume is created by volume manager (step 7015 of FIG. 8). Also, an unused LU is deleted within a storage device so as to be managed as an unused area. (See, e.g., paragraphs 28, 32-33, 35, 37, 49, 52, 54-55, 61, 63, 74-77, 94, 96, 99, 104-106; and Figures 1-6, and 8.) However, unlike the present invention, Mimatsu et al. do not teach creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received. More particularly, Mimatsu et al. do not disclose creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is

received from a host terminal which recognizes the virtual storage unit, and exchanging data between the logical storage region and the host terminal, via the virtual storage region, as set forth in claim 1. Furthermore, Mimatsu et al. do not disclose that a storage control section reports a virtual storage capacity value to the host terminal, and ensures that, after the host terminal has stored the virtual storage capacity value, the reported virtual storage capacity value is not changed while the virtual storage unit is recognized by the host terminal, as also recited in claim 1.

The published patent application to Asano et al., US 20040225697, discloses a managing computer 100, volumes 113a-113n, and a storage 11n. A volume information table 210 stores a volume capacity column 215 and a Read/Write column 216 representing read/write frequency from and to a volume set by a policy of a user and the application. A storage information table 220 stores a space capacity 222 representing a capacity of a storage space area the storage has not yet set. When receiving a replication generation request, a volume management module generates a volume of the replication source and a volume of the replication destination in a series of processing, or may acquire the request that the replication is created by use of the volumes inside the storages, or volumes between the storages. (See e.g. paragraphs 30, 37, 39-40, 51-52, 68, 75, and Figures 2-4.) However, unlike the present invention, Asano et al. do not disclose creating an association between a virtual storage region in a virtual storage unit and a logical storage region if a read request or write request is received. Thus, Asano et al. do not teach creating an

association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received from a host terminal which recognizes the virtual storage unit, and exchanging data between the logical storage region and the host terminal, via the virtual storage region, as set forth in claim 1. Additionally, Asano et al. do not disclose that a storage control section reports a virtual storage capacity value to the host terminal, and ensures that, after the host terminal has stored the virtual storage capacity value, the reported virtual storage capacity value is not changed while the virtual storage unit is recognized by the host terminal, as also recited in claim 1.

The published patent application to Tamura et al., US 20050071559, discloses a host device 10, a mapping table Tm and memories 31-32. The host device 10 recognizes only the LUN 103. The mapping table Tm can be constructed by including a memory capacity of a memory device 42. The host device 1 can write data to a logical volume (LDEV 102) provided by a first storage controller 20. A virtual device 101 is constructed by mapping the memory device 42. Thus, a logical volume provided by the memory device 42 of a second storage controller 40 can be used as an internal volume of a first storage controller 20 by mapping this logical volume to the virtual device 101 by using the mapping table Tm. (See e.g. paragraphs 41, 43, 59-62, 68-72, and Figures 1-2, and 4-5.) However, unlike the present invention, Tamura et al. do not disclose creating an association between a virtual storage region in the virtual storage unit and a logical storage region if a read

request or write request is received. More particularly, Tamura et al. do not teach creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received from a host terminal which recognizes the virtual storage unit, and exchanging data between the logical storage region and the host terminal, via the virtual storage region, as set forth in claim 1. Furthermore, Tamura et al. do not disclose that a storage control section reports a virtual storage capacity value to the host terminal, and ensures that, after the host terminal has stored the virtual storage capacity value, the reported virtual storage capacity value is not changed while the virtual storage unit is recognized by the host terminal, as also recited in claim 1.

(F) CONCLUSION

From the above discussion, it is apparent that none of the art of record shows or suggests the present invention, including creating an association between a virtual storage region in a virtual storage unit and a logical storage region in a logical storage device if a read request or write request is received from a host terminal which recognizes the virtual storage unit, and exchanging data between the logical storage region and the host terminal, via the virtual storage region, in combination with the other limitations set forth in claim 1. Furthermore, the above-discussed documents do not disclose that a storage control section reports a virtual storage capacity value to the host terminal, and ensures that, after the host terminal has stored the virtual storage capacity value, the reported virtual storage capacity value

is not changed while the virtual storage unit is recognized by the host terminal, in combination with the other limitations recited in claim 1. Accordingly, claim 1 is patentable over the cited references.

The Applicants submit that the foregoing discussion demonstrates the patentability of independent claim 1 over the closest-known prior art, taken either singly, or in combination. The remaining claims depend from claim 1, claim additional features of the invention, and are patentable at least because they depend from allowable base claims. Accordingly, the requirements of 37 CFR §1.102(d) having been satisfied, the Applicants request that this Petition to Make Special be granted and that the application be examined according to prescribed procedures set forth in MPEP §708.02 (VIII).

The Applicants prepared this Petition in order to satisfy the requirements of 37 C.F.R. §1.102(d) and MPEP §708.02 (VIII). The pre-examination search required by these sections was "directed to the invention as claimed in the application for which special status is requested." MPEP §708.02 (VIII). The search performed in support of this Petition is believed to be in full compliance with the requirements of MPEP §708.02 (VIII); however, Applicants make no representation that the search covered every conceivable search area that might contain relevant prior art. It is always possible that prior art of greater relevance to the claims may exist. The Applicants urge the Examiner to conduct his or her own complete search of the prior art, and to thoroughly examine this application in view of the prior art cited above and any other prior art that may be located by the Examiner's independent search.

Further, while the Applicants have identified and discussed certain portions of each cited reference in order to satisfy the requirement for a "detailed discussion of the references, which discussion points out, with the particularly required by 37 C.F.R. §1.111(b) and (c), how the claimed subject matter is patentable over the references" (MPEP §708.02(VIII)), the Examiner should not limit review of these documents to the identified portions, but rather is urged to review and consider the entirety of each reference.

(G) FEE PAYMENT (37 C.F.R. 1.17(i))

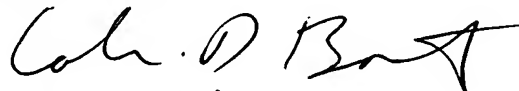
The fee required by 37 C.F.R. § 1.17(i) is to be paid by:

☒ the Credit Card Payment Form (attached) for \$130.00.

☐ charging Account 50-1417 the sum of \$130.00.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C., Deposit Account No. 50-1417. A duplicate of this petition is attached.

Respectfully submitted,



Colin D. Barnitz
Registration No. 35,061

MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C.
1800 Diagonal Rd., Suite 370
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Date: June 20, 2005

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.



PETITION FEE

Under 37 CFR 1.17(f), (g) & (h)

TRANSMITTAL

(Fees are subject to annual revision)

Send completed form to: Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

Application Number	10/822,708
Filing Date	April 13, 2004
First Named Inventor	H. WATANABE, et al
Art Unit	
Examiner Name	
Attorney Docket Number	1309.43767X00

Enclosed is a petition filed under 37 CFR §1.102(d) that requires a processing fee (37 CFR 1.17(f), (g), or (h)). Payment of \$ 130.00 is enclosed.

This form should be included with the above-mentioned petition and faxed or mailed to the Office using the appropriate Mail Stop (e.g., Mail Stop Petition), if applicable. For transmittal of processing fees under 37 CFR 1.17(i), see form PTO/SB/17i.

Payment of Fees (small entity amounts are NOT available for the petition (fees))

- ☒ The Commissioner is hereby authorized to charge the following fees to Deposit Account No. 50-1417:
- ☐ petition fee under 37 CFR 1.17(f), (g) or (h) ☒ any deficiency of fees and credit of any overpayments
- Enclose a duplicative copy of this form for fee processing.

☐ Check in the amount of \$ _____ is enclosed.☒ Payment by credit card (From PTO-2038 or equivalent enclosed). Do not provide credit card information on this form.**Petition Fees under 37 CFR 1.17(f):****Fee \$400****Fee Code 1462**

For petitions filed under:

- § 1.53(e) - to accord a filing date.
- § 1.57(a) - to according a filing date.
- § 1.182 - for decision on a question not specifically provided for.
- § 1.183 - to suspend the rules.
- § 1.378(e) for reconsideration of decision on petition refusing to accept delayed payment of maintenance fee in an expired patent.
- § 1.741(b) - to accord a filing date to an application under §1.740 for extension of a patent term.

Petition Fees under 37 CFR 1.17(g):**Fee \$200****Fee code 1463**

For petitions filed under:

- §1.12 - for access to an assignment record.
- §1.14 - for access to an application.
- §1.47 - for filing by other than all the inventors or a person not the inventor.
- §1.59 - for expungement of information.
- §1.103(a) - to suspend action in an application.
- §1.136(b) - for review of a request for extension of time when the provisions of section 1.136(a) are not available.
- §1.295 - for review of refusal to publish a statutory invention registration.
- §1.296 - to withdraw a request for publication of a statutory invention registration filed on or after the date the notice of intent to publish issued.
- §1.377 - for review of decision refusing to accept and record payment of a maintenance fee filed prior to expiration of a patent.
- §1.550(c) - for patent owner requests for extension of time in ex parte reexamination proceedings.
- §1.956 - for patent owner requests for extension of time in inter partes reexamination proceedings.
- § 5.12 - for expedited handling of a foreign filing license.
- § 5.15 - for changing the scope of a license.
- § 5.25 - for retroactive license.

Petition Fees under 37 CFR 1.17(h):**Fee \$130****Fee Code 1464**

For petitions filed under:

- §1.19(g) - to request documents in a form other than that provided in this part.
- §1.84 - for accepting color drawings or photographs.
- §1.91 - for entry of a model or exhibit.
- §1.102(d) - to make an application special.
- §1.138(c) - to expressly abandon an application to avoid publication.
- §1.313 - to withdraw an application from issue.
- §1.314 - to defer issuance of a patent.

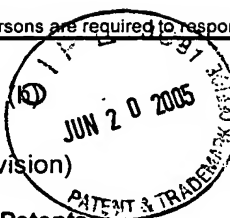
Name (Print/Type)	Colin D. Barnitz	Registration No. (Attorney/Agent)	35,061
Signature		Date	June 20, 2005

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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PETITION FEE
Under 37 CFR 1.17(f), (g) & (h)
TRANSMITTAL
(Fees are subject to annual revision)

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